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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project | Date | Author

TITLE

INSECT CONTROL FORMS AND INSTRUCTIONS

Forest Insect Laboratory
Coeur d'Alene, Idaho

SUBJECT—

INDEX NO.—

U.S. GOVERNMENT PRINTING OFFICE
FILE COPY
FOREST INSECT LABORATORY

I.C. Form A 1931

SPOTTER'S DAILY RECORD

Project Area ____________ Unit ____________ Camp No. ______

Date __________ Spotter ______________ T. ______ R. _____ Sec. ______

S	Tree No.	T	S	Tree No.	T	S	Tree No.	T	S	Tree No.	T

SPOTTERS WEEKLY REPORT

Date _____ Location of Camp _____

Crew Symbol _____ Number of Men in Crew _____

Record of Trees Marked For Treatment.

Date	Number of Trees	Sections or Area Worked	Remarks

Remaining territory to be covered from present camp _____

Number of days required to complete present camp area _____

Suggestions as to location of control camp in present area _____

Suggestions as to new location for spotters camp _____

Remarks. (Suggestions, Requirements, Etc.) _____

Signed _____
Chief of Spotting Crew.

Insect Control Form "B" No.__________

CREW FOREMAN'S DAILY REPORT

Camp______________ Unit__________________

Date______________ Man-Days________________ Horse-Days____________

____
Signature

Tree No.	D.B.H.	Length Treated	Tree Remarks	Tree No.	D.B.H.	Length Treated	Tree Remarks	Tree No.	D.B.H.	Length Treated	Tree Remarks

P.S. - Peeled Standing. B.S. - Burned Standing. U.T. - Untreated.

Insect Control Form "D" No. ________

CREW FOREMAN'S DAILY REPORT

Camp ________ Unit ________ Unit Area ________

Date ________ Man Days ________ Horses ________

____
Signature

Tree No.	D.B.H.	Length Treated	Tree Remarks	Tree No.	D.B.H.	Length Treated	Tree Remarks

I.C.Form WP "C"

CREW FOREMAN'S DAILY REPORT

Camp______________ Area______________ Forest______________________

Date______________ Man Days__________ ______________________

Signature Crew Foreman

Tree No.	D.B.H.	Length Treated	Dia. Top Section Treated	Remarks

CAMP FOREMAN'S DAILY REPORT

CAMP _____ AREA _____ FOREST _____

DATE _____ MAN DAYS _____

Signature of Crew Foreman.

Tree No.	DBH	Length Treated	Dia. at Top of Section Treated	Volume Board Feet	Square Feet Bark Surface Peeled	Remarks
Total:						

I.C. Form WP "C"

CREW PRODUCTION RECORD

______________________ (Camp) ______________________ (Area) ______________________ (Forest)

Month of ______________, 19___ Crew________________

Day	No. Trees	Total Volume	Bark Surface Peeled		Man-days	Output per Man-day			
						Trees	Vol.	Sq. Ft.	

Insect Control Form "D"

WEEKLY SUMMARY OF CREW RESULTS

Week of_________to________

Per Unit ____________

Crew Foreman	Effective Man-Days	Average per Man-Day		Remarks
		Week	Job	
Total				
Brought forward				
Grand Total				

I. C. Form E 1931

CREW PRODUCTION RECORD

Camp____________________ Area__________________ Forest____________________

Month of__________________, 193____ Crew______________________

Day	No. Trees	Man-days	Trees per Man-day	Remarks

Insect Control Form "E"

CREW RECORD FOR MONTH OF _____, 193__.

Foreman _____

Date	MAN-DAYS		NUMBER OF TREES TREATED				LABOR CHARGES°		LABOR COST PER TREE	
					Per Man-Day					
	Per Day	Total for Month	Per Day	Total for Month	Per Day	Per Month	Per Day	Per Month	Per Day	Per Month

° Labor charges include cost of skidding horses.

Insect Control Form "A"

_____ Unit _____ Camp

CAMP MANAGER'S WEEKLY REPORT

Week of _____ to _____

PRODUCTION RECORD

Day	_____ Trees Treated	Crew Man-Days	_____ Trees Treated	Crew Man-Days	_____ Trees Treated	Crew Man-Days
S						
M						
T						
W						
T						
F						
S						
Totals:						

Meals Served

Day	Number
S	
M	
T	
W	
T	
F	
S	

REMARKS:

	Noneffective Labor Man-Days	Remarks
Moving Camp		
Establishing Camp		
Fire Suppression		
Cutting Wood		
Cooks		
Flunkies		
Packer		
Saw Filer		
Horseshoeing		
Spotting		
Total		
Total Effective		
Grand Total		

Page 1

Signed _____
Camp Manager

Insect Control Form "A"

CAMP MANAGERS WEEKLY REPORT

Week of _____ to _____.

PRODUCTION RECORD

Day	_____ Trees Treated	Crew Man Days	_____ Trees Treated	Crew Man Days	_____ Trees Treated	Crew Man Days
M						
T						
W						
T						
F						
S						
S						
Totals						

Meals Served

Day	Number
M	
T	
W	
T	
F	
S	
S	
	Total man days.

Noneffective Labor

	Man Days	Remarks
Moving Camp		
Establishing Camp		
Fire Suppression		
Cutting Wood		
Total for Week		

REMARKS:

Signed _____
Camp Manager

I. C. FORM WP "A" [OGDEN-4-9-30-1000]

CAMP MANAGER'S WEEKLY REPORT

[Forest] [Unit] [Camp]

Production record for week of ..... to .....

DAY	TREES TREATED	BARK SURFACE	CREW MAN-DAYS	TREES TREATED	BARK SURFACE	CREW MAN-DAYS	TREES TREATED	BARK SURFACE	CREW MAN-DAYS
S									
M									
T									
W									
T									
F									
S									
Total									

DAY	TREES TREATED	BARK SURFACE	CREW MAN-DAYS	TREES TREATED	BARK SURFACE	CREW MAN-DAYS	TREES TREATED	BARK SURFACE	CREW MAN-DAYS
S									
M									
T									
W									
T									
F									
S									
Total									

Meals Served

DAY	NUMBER
S	
M	
T	
W	
T	
F	
S	
Tot.	

Total effective man-days treating .....

Total effective man-days spotting .....

All other man-days in camp .....

Total man-days paid .....

Total man-days contributed .....

Remarks .....

.....

.....

.....

.....

[Signature Camp Manager]

I. C. Form D 1932

CAMP MANAGER'S WEEKLY REPORT

Forest_____ Unit_____ Camp_____

Production Record for Week of_____ to_____

Day	Trees Treated	Crew Man-days	Trees Treated	Crew Man-days	Trees Treated	Crew Man-days
S						
M						
T						
W						
T						
F						
S						
TOTAL						

Grand total trees spotted_____ Grand total trees treated_____

Meals Served

Day	Number
S	
M	
T	
W	
T	
F	
S	
TOTAL	

A. Total effective man-days treating_____

B. Total effective man-days spotting_____

C. All other man-days_____

D. Total man-days paid_____

E. Total man-days contributed_____

A, B, and C should equal D and E.

Remarks:_____

Signed_____
Camp Manager

A. Includes Crew Foreman and all men contributing to the actual treating of trees.
B. Includes Chief Spotter and all men of spotting crew.
C. Includes Camp Manager, Cooks, Flunkey, Bull Cook, etc.
D. All man-days paid from project funds.
E. All contributed man-days except supervising overhead not attached to camp.

March, 1931.

MEMORANDUM TO SPOTTERS

CONTROL OF MOUNTAIN PINE BEETLE IN WHITE PINE

The purpose of this memorandum is to outline to the men acting as spotters in connection with this project, their duties, the methods of spotting to be employed, and to present some general information which is hoped will prove to be of assistance. It is impossible to foresee and discuss all of the variations of the problem of spotting which you will encounter in the field, nor is it possible for the officer in charge of the project, or camp manager, to be on the ground with you to assist in the solution of the confusing situations with which you will no doubt be confronted. As much supervision and instruction will be given you as is possible. The officer in charge of the project and the camp manager will visit you as often as possible, but there will be times when it will be necessary for you to make immediate decisions on the ground, and in such cases the responsibility will rest directly upon the chief spotter.

In all forest insect control projects, spotting is the first and most important step of the operation. A large per cent of the infested trees which are missed by the spotters will remain untreated, leaving a potential source of reinfestation within the area, which often defeats the purpose of the project. In addition to the potential danger of such trees, and after the project has been put to the expense of establishing a camp within an area it is economically essential that all infested trees within the area covered by the survey be marked for treatment. In brief, then, it is the duty of the spotters to locate, tag, and map, as efficiently and economically as possible, <u>all</u> infested trees within the areas assigned to them.

Accountability of Spotting Crews

Spotting crews are a part of the regular camp organization and are responsible to the camp manager. They will be expected to assist in the moving and establishment of camp, and in all other duties of the camp organization. The chief of spotters will deal with the camp manager relative to the assignment of areas to be spotted, forms, reports, and supplies.

Methods of Spotting

The general method of spotting to be employed will be a 100 per cent survey, and it is believed that this method will be necessary for all of the white pine stands under consideration. When one-chain strips are used, and crews are properly

organized and directed, a 5-man crew will be found to be as efficient and more economical than a 3-man crew, as the requirements for chief spotters are reduced.

The chief of party, or chief spotter, will be responsible for the compass work, the pacing, construction of a map showing the number and location of all infested trees, and the proper selection of the insect-attacked trees for treatment. With all isolated or small groups of infested trees the D.B.H. or average D.B.H. of the group will be shown on the map in addition to the location, and tree numbers. Each spotter will be responsible for the location and marking of all infested trees within a strip one chain wide on one side and parallel to the course of the compass man. Each infested tree will be marked with a white cloth tag, 4x6 inches, on which will be written with lumberman's crayon the crew symbol, the tree number, and a place for the S.D. (stump diameter) and L.T. (length treated). Each spotter will carry his own supply of tags which, with the exception of the tree number, he will have previously prepared in camp. As the tags are prepared each spotter will place his initials in the lower right-hand corner. When an infested tree is located the spotter will ask the chief of party for a tree number which he will write upon the tag. The tags are fastened to the tree with a tack in each upper corner. When groups of infested trees are found all of the spotters will assist in the marking, each one securing a number from the chief of party as each infested tree is located. If a group of infested trees extends off of the strip being covered, all of them will be marked at that time, regardless of their location. The chief spotter, in addition to the map, of which two copies will be required, will keep the "Spotter's Daily Report" (Insect Control Form A), and the "Spotter's Weekly Report" (Insect Control Form B).

Importance of Spotting

In considering the importance of spotting there are two phases which must be considered. These are the importance of locating all of the infested or attacked trees within an area, and the proper selection of them for treatment after they have been located. Of the two, the latter is the most complicated. The location of infested or insect-attacked trees is but a mechanical operation which, if one is alert, can be made nearly 100 per cent effective. With the problem of determining if a tree which shows the external signs of a bark beetle attack should be marked for treatment, more serious difficulties are involved.

The insect we are combating is known as the mountain pine beetle (Dendroctonus monticolae), which attacks and kills healthy, mature western white pine, western yellow pine, lodgepole, sugar pine, white-bark pine, and sometimes Engelmann spruce when in association with infested pine. The adult insects are rather stout, black, cylindrical barkbeetles, varying in length from 3½ to 6½/25 of an inch. These beetles

bore through the outer bark and construct long perpendicular egg galleries directly beneath the bark, which slightly groove the wood and extend up the tree. At the bottom or start of these galleries, which vary in length from 12 to 30 inches, there is normally a slight crook of an inch or more. Eggs are deposited along this gallery which soon hatch into small white grubs or larvae. In feeding, these larvae excavate individual larval mines at right angles to the egg gallery, which vary in length and width, and are exposed on the surface of the inner bark. When mature the larvae construct a small cell at the end of the larval mine in which the transformation to the new adult takes place. During this transformation the insect goes through what is called the pupal stage, and the small cell is termed a pupal cell.

When the transformation is complete the new adults bore away the intervening bark between cells and congregate beneath the bark for some time before emergence, or they may bore emergence holes directly out from the pupal cells. When emerging after congregating several insects may use the same emergence hole, or quite often advantage is taken of cracks in the bark, woodpecker work, etc.

Location of Insect-infested Trees

Insect-attacked trees are first located by the presence of small pitch exudations (pitch tubes) which form at the mouth of the entrance hole, or by the boring dust at the base of the tree. Pitch tubes are not always present. When the attack is extremely heavy there are very few, if any, to be seen, so one cannot depend upon this rule as an infallible guide. This is easily explained by the fact that the total flow of pitch is distributed through so many entrance holes that there is not sufficient to form tubes. On the contrary when the attacks are light, the flow of pitch is so strong that the attacking beetles are washed from their galleries and the attack is unsuccessful. Large pitch tubes are usually, though not always, an indication of a pitched-out attack. Fresh woodpecker work is a true indication that there were and possibly are insects beneath the bark. However, it does not prove that the insect is the mountain pine beetle. Later in the season the foliage of the infested trees begins to fade, which can be used as a guide to infested groups. This may occur in some areas in the fall, but by April or May a large per cent of white pine trees attacked the previous season will show discolored foliage.

There is no infallible rule which can be given to you for the proper marking of infested trees from external evidence. The rules which have been listed will lead you to the tree that has been attacked, then it is for you to determine if it should be marked for treatment. It will be necessary for you to examine nearly every tree by removing a piece of the bark. If you find that the tree was killed by the mountain

pine beetle and that there are insects beneath the bark, then it should be marked for treatment. By insects we mean the developing broods resulting from the parent adults of the mountain pine beetle which attacked the tree the previous summer. These may be as larvae, pupae, or new adults. When present the parent adults you will find in the top of the old egg gallery. Normally they will be dead, but do not mark trees for treatment on the strength of these old black parent adults, for even if alive they carry very little, if any, potential danger to the green trees adjacent. The new adult will vary in color, appearing first as pure white to brown and then to black prior to emergence.

It is in the marking of trees for treatment which show external evidence of attack that the good judgment of the spotters must be called upon. In this connection it is necessary that the spotters have a general idea of the seasonal history of the mountain pine beetle. The manner in which this insect works has been described to you so that in a very short time you can determine if the tree has been attacked by this insect. However, it must then be determined if the insect broods are still present beneath the bark before the tree can be marked for treatment, as it is very obvious that there would be little accomplished by peeling trees from which the beetles had emerged.

Though there is but one generation of the mountain pine beetle per year, an overlapping of the broods does occur which often causes confusion to the spotters. Normally the insect passes the winter as a larva which matures into a new adult during June and emerges in July. However, deviations from this rule are often encountered and broods are often found overwintering in the egg and new adult stage. During long seasons the insect broods from early attacks often mature and pass the winter as new adults instead of larvae. These new adults emerge during June and attack new trees so that during the course of a project where trees containing overwintering larvae are being treated, one will often encounter trees with new adults, as well as new attacks. Such trees are always in the minority and serve as the exception rather than the rule, but their occurrence often confuses the spotters. Trees containing new adults could be successfully treated by burning, but if there are only a few of them it is believed that a sufficiently large enough per cent of the mature beetles would be destroyed by the mechanical action of peeling, as well as an added mortality through the feeding of birds and rodents, to warrant such action. With the early new attacks, if during the latter part of the season the broods are in an egg or larval stage and from 6-12 inches of egg gallery has been constructed, the trees should be peeled.

Another complication which may be encountered is when the attack only exists on one side of the basal portion of the tree. Infested trees of this character are often missed

by the spotters passing by the unattacked side of these trees, but the most serious complication or confusion which will arise from these trees is when the uninfested portion of the tree is attacked later in the season, or the following season. This results in the spotters finding insect broods in this basal portion of the tree when the insects have emerged from the remainder. With a little practice these trees can be easily determined, and passed without marking. The fact that the foliage has fallen from the limbs with the general condition of the trees will indicate that the insects are to be found in the base only, usually on one side, and that by the time the spotter's examination has been completed the tree will have been treated.

FORMS

Marking Tags

The trees selected by the spotters for treatment will be marked with a white tag, 4x6 inches in size, which is made from sign painter's cloth. These tags will be prepared by the spotters so as to show the symbol of the spotting crew, "A", "C", "E", etc., tree number (163), and a place for the diameter breast high (D.B.H.), length treated (L.T.), and the diameter of the bole at the height to which it is peeled (top diameter - T.D.). With the exception of the tree number these legends are placed upon the tags by the spotters before going into the field. At the time the tree is treated the tag is removed by the crew foreman who places upon it the D.B.H., length treated, and the diameter at the top of the treated portion of the bole. These tags are preserved and used by the crew foreman in working up his daily report.

Maps

Standard map sheets (878) are used in the preparation of the spotters' maps. They should be carefully and accurately prepared. It is from these maps that the trees are relocated for treatment. An error may result in a treating crew marking time for several hours, or cause the crew foreman unnecessary time and labor in relocating the trees marked. A little extra care on your part may save someone hours of unproductive effort. Only one section or part thereof should be shown on one sheet. If desired to show parts of two sections, two separate map sheets should be used. Only the essential data should be shown on the map, and the little details, which are of no real value and only tend to complicate the reading of the map, should be omitted. Trails, streams, ridges, peaks, fences, cabins, telephone lines, etc., are some of the essential features which should be shown on the maps.

Spotter's Daily Report (I.C. Form A)

This form will be used by the chief of spotters for the purpose of keeping a record of the tree numbers used. These numbers which are kept consecutively by each crew will be placed upon the form prior to going into the field, and as a spotter calls for a number it will be checked off in the narrow column captioned "S" (Spotted). This form is prepared in duplicate. The original will go to the camp manager and the copy to project headquarters.

As the tree tags are turned in by the crew foremen the camp manager will check off the numbers on this form in the column captioned "T" (Treated), which will show if all of the trees spotted have been treated. As soon as these sheets have been completely checked, or an area treated, they will be forwarded to project headquarters. The space provided for the acreage covered should be accurately filled out for each day.

Spotter's Weekly Report (I.C. Form B)

This form is prepared by the chief of each spotting crew for the purpose of reporting the results accomplished during the past week, as well as general information relative to the amount of territory remaining to be covered from the present camp and the amount of time required. Suggestions as to the location of control camps in order that they may be centrally located to the trees marked, and information relative to the moving of the spotter's camp should be included; in fact all information which you feel would be of interest and service to the unit and project manager. Report will be prepared in duplicate, one copy to the unit manager and one copy to the project headquarters.

Chief spotters should bear in mind that it is to them that the camp manager will often turn for information to assist in the organization of his treating crews. Scattered infestations, for example, call for different treating crew organization than that required for large groups of infested trees. By keeping this fact in mind the chief spotters can secure and include in their weekly reports all such data as will prove to be of assistance to the camp manager.

CONCLUSIONS

As previously stated it is impossible for us to discuss in detail all of the problems with which you will be confronted. It will be necessary for you to make your own decision to the best of your judgment. There are no doubt items omitted from this memorandum which would have been of interest and service to you. As these occur to us, or are called to our attention, additional memoranda will be circulated. In closing let me again impress upon you that the spotting crews are an important

part of this project, and it is up to every spotter to assist in making his crew an effective and efficient organization.

J. C. Evenden,
Entomologist.

Approved:

Elers Koch,
Assistant Regional Forester.

Memorandum to Spotters:

Control of Mountain Pine Beetle in Lodgepole Pine

The purpose of this memorandum is to outline to the men acting as spotters in connection with this project, their duties, the methods of spotting to be employed, and to present some general information which is hoped will prove to be of assistance. It is impossible to foresee and discuss all of the variations of the problem of spotting which you will encounter in the field, nor is it possible for the officer in charge of the project, or camp manager, to be on the ground with you to assist in the solution of the confusing situations with which you will no doubt be confronted. As much supervision and instruction will be given you as is possible. The officer in charge of the project, camp manager, officers of the Bureau of Entomology, etc., will visit you as often as possible, but there will be times when it will be necessary for you to make immediate decisions on the ground, and in such cases the responsibility will rest directly upon the chief spotter. When your best efforts are employed in making such decisions that is all that can be asked of you.

In all forest insect control projects, spotting is the first and most important step of the operation. The task of spotting is to locate the infested trees for the treating crews. A large per cent of the infested trees which are missed by the spotters will remain untreated, leaving a potential source of reinfestation within the area, which often defeats the purpose of the project. In addition to the potential danger of such trees, and after the project has been put to the expense of establishing a camp within an area it is economically essential that all infested trees within the area covered by the survey be marked for treatment. In brief, then, it is the duty of the spotters to locate, tag, and map, as efficiently and economically as possible, <u>all</u> infested trees within the areas assigned to them. It may prove expedient to allow some small isolated trees to go untreated, if they are remote from the activity of the control crews. However, the responsibility for such eliminations, or decisions <u>will rest</u> with the camp manager, <u>and not</u> the chief spotter.

Accountability of Spotting Crews

Spotting crews are a part of the regular camp organization and are responsibile to the camp manager. They will be expected to assist in the moving and establishment of camp, and in all other duties of the camp organization. The chief of spotters will deal with the camp manager relative to the assignment of areas to be spotted, forms, reports, and supplies.

Methods of Spotting

The general method of spotting to be employed should be a 100 per cent survey, and it is believed that this method will be necessary for a

large per cent of the lodgepole pine stands under consideration. However, it is often feasible, as well as advantageous, to vary this method to meet other conditions when encountered.

All large or solid bodies of lodgepole pine should be covered by a 100 per cent survey. The size of spotting crews that will be found most efficient, will vary with the nature of the terrain being covered. In normal lodgepole forests a five-man crew gives the best results. A larger crew is too unwieldy and can not keep in contact with the compass man, or guide of the party, and a three-man crew requires an additional compassman, with no greater amount of territory being covered. A five-man crew will under ordinary conditions cover as much ground as two 3-man organizations and the expense of one compassman is eliminated. In extremely rough and brushy country a 3-man crew might prove more efficient, though it is doubted.

Spotting crews operate, by gridironing a section, or block of timber, traveling on a definite compass line. Trails, roads, streams, ridges, etc., can be used for base lines when spotting is being conducted in unsurveyed country, or where the timber type is broken up into narrow belts or small blocks. As the direction of a strip is reversed the spotter who was on the outside should go back on the inside of the new strip. As he is familiar with the country covered he can assure himself that no gaps have been left between the two strips. As strips cross main trails or roads, it is a good plan to fasten a tag showing the number of the strip to a tree or stump. The strip can be identified from spotter's maps and such information often proves to be of assistance to treating crew foreman in relocating marked trees.

This method of spotting can be adapted to meet all conditions encountered. In the adoption of this method it is not necessary to cover a lot of timberless territory when types are encountered that are broken up into small blocks or strips. Each block of timber can be worked independently, the strips starting from some local point such as a bridge, gate, etc., so that the map can be accurately prepared.

It is possible that in working a narrow, meandering belt of timber it might be advisable to forego the running of a compass line. However, the same formation of spotters should be followed, only the guide would be the man covering the outside strip instead of the center man. If this guide is to the right then each spotter should conform to the direction being followed by keeping the proper distance away from the man to his immediate right. In this way each man becomes a guide for the man to his left. A better alignment and proper distances are maintained if the line of spotters is staggered or echeloned to the rear. To accomplish this each spotter should walk a few paces behind a line perpendicular to the course which the man who is acting as his guide is following. This is also true when a compass line is being used, and the guide is in the center of the formation. Under such an organization the crew assumes the shape of an inverted V with the compassman at the apex. When no compass line is used and it is necessary that two or more strips be run to cover the area, it is essential that the inside man mark his line in some way so that on the return trip he can follow it correctly in order that none of the area is

missed. Though it may be found expedient to abandon the compass under certain conditions, it will still be necessary in practically all cases to pace the distance traveled. This data is essential for the proper location of the infested area on the spotter's map, in order that the trees marked for treatment can be relocated with a minimum of effort on the part of the treating crew foremen.

It is difficult, in fact impossible, to visualize all types of conditions in order to offer tentative solutions. As stated it will often be necessary for chief spotters to make immediate decisions upon the ground. If one bears in mind that the task of spotting is the location of the infested trees for the treating crews, there will be no question but that such decisions will be correctly made. A method of spotting which does not locate such trees so they can be relocated with the least possible effort is in most cases an improper one to use. Good business judgment must of course be considered in making all decisions in order that spotting will not be carried to an unwarranted extreme.

The chief of party, or chief spotter, will be responsible for the compass work, the pacing, construction of a map showing the number and location of all infested trees, and the proper selection of the insect-attacked trees for treatment. With all isolated or small groups of infested trees the D.B.H. or average D.B.H. of the group will be shown on the map in addition to the location, and tree numbers. Each spotter will be responsible for the location and marking of all infested trees within a strip one chain wide on one side of and parallel to the course of the compass man. It is possible that the width of this strip could be increased for open stands of timber. Each infested tree will be marked with a white tag of cloth or paper, on which will be written with lumberman's crayon the crew symbol and the tree number. Each spotter will carry his own supply of tags on which he will have previously placed the crew symbol about an inch from the top and his initials in the lower right-hand corner. When an infested tree is located the spotter will ask the chief of party for a tree number which he will write upon the tag. The tags are fastened to the tree with a tack in each upper corner. When groups of infested trees are found all of the spotters will assist in the marking, each one securing a number from the chief of party as each tree is located. If a group of infested trees extends off of the strip being covered, all of them will be marked at that time, regardless of their location. The chief spotter, in addition to the map will keep such other records as are required by the officer in charge of the project.

It is possible that in areas where it is found that the infestation is of sufficient intensity, the task of providing a control crew with infested trees will be assigned to one man. In such cases the duties of this man will be to locate all of the infested trees in the section assigned to the control crew. It will be necessary for him to provide the crew foreman with suitable maps showing the location and number of the infested trees. Trees will be tagged in the same manner as outlined for the spotting crews. It will also be necessary for this spotter to keep such other reports as required by the officer in charge of the project.

this method is applicable for heavy infestations where one man can take a small area and by constantly working through it he can locate all of the infested trees, which in such situations usually occur in large groups.

During very early seasons it is possible that in June the foliage of infested lodgepole will be faded to a degree that will permit the adoption of a topographic method of spotting. In the employment of this method of spotting the foliage is used entirely as a guide to the infested trees. The method is only applicable in regions where the infested trees show discolored foliage. The infested trees are first spotted, from opposite hillsides and all other advantageous lookout points, and their approximate location placed upon a map. The trees spotted in this manner are then visited by the spotter, examined, marked for treatment, and their location carefully checked on the map. In regions where the terrain lends itself to this method of spotting it is possible for one or two men to adequately cover large areas very efficiently and economically.

Importance of Spotting

In considering the importance of the actual spotting of infested trees there are two phases which must be considered. These are the importance of locating all of the infested or attacked trees within an area, and the proper selection of them for treatment after they have been located. Of the two, the latter is the most complicated. The location of infested or insect attacked trees is but a mechanical operation which, if one is alert, can be made nearly 100 per cent effective. With the problem of determining if a tree which shows the external signs of a bark beetle attack should be marked for treatment, more serious difficulties are involved.

The insect we are combating is known as the mountain pine beetle (Dendroctonus monticolae), which attacks and kills healthy mature western white pine, western yellow pine, lodgepole, sugar pine, white-bark pine, and sometimes Engelmann spruce when in close association with infested pine. The adult insects are rather stout, black, cylindrical barkbeetles, varying in length from 3½ to 6½/25 of an inch. These beetles bore through the outer bark and construct long perpendicular egg galleries directly beneath the bark, which slightly groove the wood and extend up the tree. At the bottom or start of these egg galleries, which vary in length from 12 to 30 inches, there is normally a slight crook of an inch or more that starts at the entrance hole. Eggs are deposited along this gallery which soon hatch into small white grubs or larvae. In feeding, these larvae excavate individual larval mines at right angles to the egg gallery, which vary in length and width, and are exposed on the surface of the inner bark. When mature the larvae construct a small cell at the end of the larval mine in which the tranformation to the new adult takes place. During this transformation the insect goes through what is called the pupal stage, and the small cell is termed a pupal cell.

When the transformation is complete the new adults bore away the intervening bark between cells and congregate beneath the bark for some time before emergence, or they may bore emergence holes directly out from

the pupal cells. When emerging after congregating several insects may use the same emergence hole, or quite often advantage is taken of cracks in the bark, woodpecker work, etc.

Location of Insect-Infested Trees

Insect-attacked trees are first located by the presence of small pitch exudations (pitch tubes) which form at the mouth of the entrance hole, or by the boring dust at the base of the tree. Pitch tubes are not always present. When the attack is extremely heavy there are very few, if any, to be seen, so one cannot depend upon this rule as an infallible guide. This is easily explained by the fact that the total flow of pitch is distributed through so many entrance holes that there is not sufficient to form tubes. On the contrary when the attacks are light, the flow of pitch is so strong through the few holes that the attacking beetles are washed from their galleries and the attack is unsuccessful. Large pitch tubes are usually, though not always, an indication of pitched-out attack. Fresh woodpecker work is a true indication that there were and possibly are insects beneath the bark. However, it does not prove that the insect is the mountain pine beetle.

In marking lodgepole pine for treatment one will often be called upon to determine between the work of the mountain pine beetle and different species of Ips. The best plan to follow is to familiarize oneself with the characteristic gallery pattern of the mountain pine beetle, and to disregard all others. A point to be remembered is that the egg gallery, or main channel of mountain pine beetle work is always packed solid with sawdust, except for an inch or two at the upper end, while with Ips this gallery, which is often forked, is kept free from sawdust. Later in the season the foliage of the infested trees begins to fade, which can be used as a guide to infested groups.

There is no infallible rule which can be given to you for the proper marking of infested trees from external evidence. The rules which have been listed will lead you to the tree that has been attacked, then it is for you to determine if it should be marked for treatment. It will be necessary for you to examine nearly every tree by removing a piece of the bark. If you find that the tree was killed by the mountain pine beetle and that there are sufficient insects beneath the bark, then it should be marked for treatment. By insects we mean the developing broods resulting from the parent adults of the mountain pine beetle which attacked the tree the previous summer. These may be as larvae, pupae, or new adults. The parent adults you will find in the top of the old egg gallery. Normally they will be dead, but do not mark trees for treatment on the strength of these old black parent adults, for even if alive they carry very little, if any, potential danger to the green trees adjacent. The new adult will vary in color, appearing first as pure white to brown and then to dark black prior to emergence.

It is in the marking of trees for treatment which show external evidence of attack that the good judgment of the spotters must be called

upon. In this connection it is necessary that the spotters have a general idea of the seasonal history of the mountain pine beetle. The manner in which this insect works has been described to you so that in a very short time you can determine if the tree has been attacked by this insect. However, it must then be determined if the insect broods are still present beneath the bark before the tree can be marked for treatment, as it is very obvious that there would be little accomplished by treating trees from which the beetles had emerged.

In lodgepole pine, though there is but one generation of the mountain pine beetle per year, an overlapping of the broods does sometimes occur during long seasons causing confusion to the spotters. Normally the insect passes the winter as a larva which matures into a new adult during the latter part of June and July. Emergence occurs during the latter part of July and the new attacks take place in August. However, deviations from this rule are often encountered.

Another complication which may be encountered is when the attack only exists on one side of the basal portion of the tree. Infested trees of this character are often missed by the spotters passing by the unattacked side of these trees, but the most serious complication or confusion which will arise from these trees is when the uninfested portion of the tree is attacked later in the season, or the following season. This results in the spotter's finding insect broods in this basal portion of the tree when the insects have emerged from the remainder. With a little practice these trees can be easily determined, and properly marked.

Instructions will be submitted by the officer in charge of the project relative to the forms which are to be prepared and submitted by the Chief Spotter, method of marking trees, maps etc.

JAMES C. EVENDEN
Entomologist

Approved
C. B. Morse
Assistant District Forester

F O R M S

Marking Tags:

The trees selected by the spotter for treatment will be marked with a tag, 4 x 6 inches in size which is made of cardboard or sign painters cloth. These tags will be prepared by the spotters so as to show the symbol of the spotting crew, "A", "C", "E", etc., the tree number (163) and the spotters' initial in the lower right corner. With the exception of the tree number, these legends are placed on the tags by the spotters before going into the field. At the time the tree is treated the tag is removed by the burner and turned in at the end of the day for checking on the records of trees treated.

Maps:

Standard map sheets (878) are used in the preparation of the spotters' maps. They should be carefully and accurately prepared. It is from these maps that the trees are relocated for treatment. An error may result in a treating crew marking time for several hours, or cause the crew foreman unnecessary time and labor in relocating the trees marked. A little extra care on your part may save someone hours of unproductive effort. Only one section or part thereof should be shown on one sheet. If desired to show parts of two sections, two separate map sheets should be used. Only the essential data should be shown on the map, and the little details, which are of no real value and only tend to complicate the reading of the map, should be omitted. Trails, streams, ridges, peaks, fences, cabins, telephone lines, etc., are some of the essential features which should be shown on the maps. For convenient copying in the field a supply of the transparent sheets, Form 878-B may be used.

Spotters' Daily Report:

For this purpose scale book Form 231 will ordinarily be used (although the large form book 223 may be used) by the chief of the spotters crew for keeping a record of tree numbers tagged. The old form now obsolete is the best for this purpose. The numbers which are kept consecutively by each crew will be indicated in the book form prior to going into the field, the initial number only on a page being necessary. Following the tree number, a column will be designated "S" and when a spotter calls for a number, the chief spotter will place a check mark in the column opposite the number given the spotter. As the tree tags are turned in by the crew foreman, the camp manager will check off the numbers in this record in another column headed "T". This record will be preserved for the preparation of the project report.

Spotters' Weekly Report:

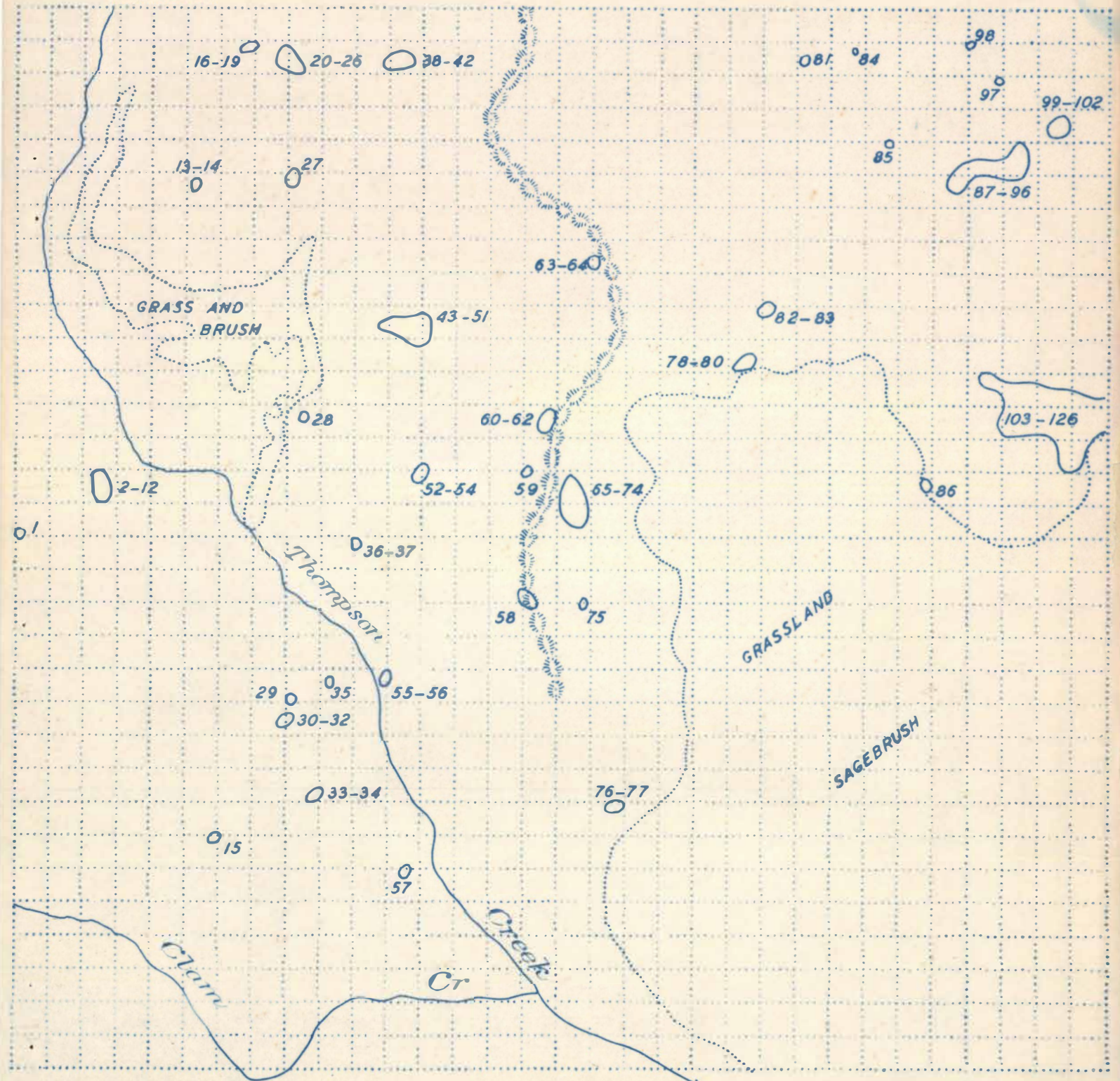
This form is prepared by the chief of each spotting crew for the purpose of reporting the results accomplished during the past week, as well as general information relative to the amount of territory remaining to be covered from the present camp and the amount of time required. Suggestions as to the location of control camps in order that they may be centrally located to the trees marked, and information relative to the moving of the spotters' camp should be included; in fact all information which you feel would be of interest and service to the unit and project manager. Report will be prepared in duplicate, one copy to the unit manager and one copy to the project headquarters.

Chief spotters should bear in mind that it is to them that the camp manager will often turn for information to assist in the organization of his treating crews. Scattered infestations, for example, call for different treating crew organization than that required for large groups of infested trees. By keeping this fact in mind the chief spotters can secure and include in their weekly reports all such data as will prove to be of assistance to the camp manager.

UNITED STATES DEPARTMENT OF AGRICULTURE—FOREST SERVICE

Land District. Mag. Declin. Area Acres

(Case designation.) SEC. 30 (Subdivision and section.) T. 1 N. R. 15 W. Mer. Scale 8 inches = 1 mile



Field work by ....., Date JUNE 12, 1928 Platted by PETERSON

Remarks: NO. OF TREES 126

Approved ....., 19....., (Approving officer.)

Form 8786. (Revised April, 1916)

B

May 1, 1930.

Instruction for Burners:

Control of Mountain Pine Beetle in Lodgepole Pine

The object to be obtained in this method is to generate sufficient heat on the bark of the tree to kill the developing broods of young beetles which are working between the bark and the wood. The effectiveness is very largely dependent on the care exercised and skill developed in the application of the oil to the trunk and the handling of the fire. Tops, bases or other sections of the trunks containing broods which are insufficiently treated, defeat the purpose of a lot of other very effective work. The insects occur principally in the main bole of the tree and seldom in any tree or section under six inches in diameter. Sometimes they may be on only one side of a tree.

The equipment used consists of compressed air sprayers of four gallons capacity equipped with carrying strap, oil resistant hose or metal tubing connections to an automatic shut-off and a long nozzle having an aperture the size of a No. 55 drill. Careful experiments have demonstrated that this size and form of nozzle gives best results with the oil. The light fuel or gas oil used has somewhat the burning qualities of kerosene but costs considerably less. In timber where the infested portion extends much beyond 30 feet high, particularly where the boles are clean and free from limbs, it is necessary to use steel extensions which are made in sections three feet long. By coupling three of these together the oil may be thrown somewhat in excess of 30 feet high. Cases are provided so that several sections of the extensions may be carried with the pack outfit supplying the burners with oil.

The crews for this work regularly will consist of one foreman, two or three burners, and a packer with pack horse. The packer keeps a supply of oil at hand for the burners by packing from a supply which is either hauled out in the drums or packed to some point in the general vicinity of the work. The foreman besides supervising the work of the burners, checks up the location of scattered trees, locates tagged groups of trees ahead of the burner, checks the distribution of the oil supply for future work and keeps watch for infested trees missed by either spotters or burners. The foreman will have plenty to do in keeping the work so lined up that the burners can walk directly from one group to another without waste of time or effort and in getting the work done <u>right.</u> 100% perfect treatment is the objective. He is directly responsible for all tagged trees on an area being properly treated. The burners gather the tags from trees to be treated, apply the oil and carry out the burning under the direction of the crew foreman.

The tanks are filled about three-fourths full of the oil and pumped up to a moderate pressure. Too high pressures cause breaking up of the oil stream. A few tests will give the burner an idea of the feeling of the pump when the most effective pressure is obtained, which is about 20 pounds, and as far as possible this pressure should be maintained at about this point. For most men the tank is carried more effectively on the left shoulder at an angle of about 35° with the body. The automatic shut-off is operated by the right hand. The oil is rather caustic and will blister the skin if it comes in contact with it to any considerable extent. For this reason the clothing should be such as will give good protection and spilling of the oil on the clothes or hands should be avoided as far as possible. Burners are required to carry a large rag along to wipe the oil off of the outside of the tank after filling. The rag can be carried between the lower end of the strap and the tank where it will dry out sufficiently for long use. Plenty of extra clothing should be available to allow frequent changing since more or less spattering with oil is unavoidable. Unguentine should be used freely where burning has occurred. Precautions should be taken to see that oil soaked clothing does not become ignited.

Before starting to apply oil to a tree the burner will remove the spotting tag which should be preserved. At the end of the day these removed tags will be arranged in numerical order and passed in to the crew foreman for transferring to his record of trees burned. Any unburned trees left will be checked up and located if possible before the work on any area is considered completed. Watch should be maintained for any infested trees which may have been missed in spotting, and any found reported to the crew foreman who will carry blank tags to use for keeping a record of trees missed by the spotters.

Before starting to throw the oil on a tree note should be made to see that there is sufficient oil and air pressure to complete the application. A stream of oil is directed against all parts of the trunk up as far as there is any indication of insect work, care being taken to distribute it evenly and avoid spattering. The base of the tree often has thicker bark and particular care must be taken to soak this section thoroughly. Since it is desired to create intense heat and burn out the entire top if possible, advantage should be taken of any heavy or dry limbs close to the trunk and oil sprayed on them. When there is considerable wind it is necessary to give a thorough soaking on the side of the trunk towards the wind, and oftentimes it is better to use little or no oil on the side away from the wind except at the base of the tree or after the fire is started. If two or more trees to be treated stand close together they should be sprayed and burned at one time since added heat and a better burn results. After the trunk has been soaked throughout added pressure is pumped in the tank if necessary and a lighted match thrown at the base of the tree. As the flame starts, additional oil is sprayed on to build up as much volume of flame as possible and this is carried on up the tree. A good flame developed at first results in a hotter burn and more frequent crowning out with less oil than if the fire starts slowly and it is necessary to attempt to build up the flame after the bark has been partially burned.

When the bark is cold or immediately following storms a greater amount of oil is necessary than when the bark is warm and dry. Green trees also require more heat than those considerably dried out. Where there is any doubt about the treatment reaching high enough to kill all the bugs the extensions should be used. It is much more effective to use them and burn out the tree at one burning than to have to go back and attempt to burn out the top after the lower part is burned. Sometimes poles or brush placed against the base of the tree helps to carry the fire up. Do not hesitate to ask the crew foreman whenever there is any question regarding whether or not the burning is being properly done. Cold winds greatly retard the effectiveness of treatment and it may at times be advisable to burn in the evening or at night where such interference becomes serious. The same action may be necessary towards the later end of the treating season when danger of the fire running develops. General action to prevent fire spreading may be avoided by taking advantage of the early morning or evening hours to burn certain sections having bad fire conditions or those where the wind strikes. These may often be treated following rains or showers.

Care and attention to details in this matter develop the skill of the burner and enable more efficient burning to be accomplished with the expenditure of less oil and a constant effort to improve the quality of one's work should be made. There are many details which cannot be covered in a memorandum of this nature and much depends on the individual efforts of the burners to make the work effective with the least possible expenditure of oil and time. All the packing, mapping and spotting, in fact all the results of the entire effort are dependent upon the efficiency of the burning operation.

Summary for Effective Work

Avoid: Wasting oil.
Useless treatment
Skipping infested sections.
Insufficient heat at base.
Missing any bug infested tree.
Lighting before you are ready.

Do: Reach all infested sections of the tree.
Distribute the oil evenly and thoroughly.
Make sure you have oil and air pressure to build up heat after lighting.
Build up a quick heat.
Make sure the heavy bark at the base of the tree is well treated.

GET ALL THE BUGS

Remember we may have 10 infested trees next year for every one we miss this year.